



**Outbreak of Serious
Pneumococcal
Disease in a
Belfast Shipyard
April-May 2015

Final Report**

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1. Introduction

This is the report of the interagency Outbreak Control Team (OCT) of an investigation of an outbreak of serious pneumococcal disease which occurred during April to May 2015 in a shipyard in Belfast. Organisations and individuals represented on the OCT are provided in Appendix 1.

The report describes the chronology of the outbreak, control measures implemented, and the outcome of epidemiological, environmental health and microbiological investigations. The report concludes with recommendations for Health and Safety Executive Northern Ireland (HSENI) to ensure all companies employing welders are aware of the guidance around personal protective equipment (PPE) and vaccinations, and for shipyard management and other employers of large transient multinational workforces to ensure provision of local occupational health services and general practice registration.

2. Background on Pneumococcal Disease

Pneumococcal disease is caused by the bacterium *Streptococcus pneumoniae* (pneumococcus)¹, an encapsulated Gram-positive coccus, of which there are more than 90 serotypes. Infections caused by *S. pneumoniae* are associated with a spectrum of disease, ranging from milder illnesses such as otitis media and sinusitis, to presentations such as pneumonia, bacteraemia and meningitis. Invasive pneumococcal disease (IPD) is defined as pneumococcal infection of any usually sterile site and includes pneumococcal meningitis, bacteraemia, empyema, arthritis and peritonitis². The case fatality rate for hospitalised adults is estimated at 12%³. Serious pneumococcal disease is defined as either invasive disease, or pneumococcal pneumonia.

The bacteria can be carried asymptotically in the nasopharynx, with carriage rates estimated at >40% in pre-school children, falling to <10% in young adults².

Pneumococci are spread via respiratory droplets or direct contact with respiratory secretions of cases or carriers. Transmission typically requires close or prolonged contact. The incubation period is generally accepted to be between 1 and 3 days.

Invasive pneumococcal disease (IPD) affects all age groups, however the very young and elderly are particularly at risk, as are those with splenic dysfunction, solid organ (e.g. lung, heart, liver and kidney) dysfunction and impaired immunity⁴. In the United Kingdom (UK), vaccination is recommended for infants as part of the routine schedule, as well as for over 65 year olds and those in clinical risk groups. There is a recognised association between exposure to metal fumes and pneumonia, and between welding and IPD. UK immunisation guidance recommends that consideration should be given to vaccinating those at risk of frequent or continuous occupational exposure to metal fume, taking into account the exposure control measures in place⁴.

¹ Public Health England - Pneumococcal disease: guidance, data and analysis.

² Interim UK guidelines for the public health management of clusters of serious pneumococcal disease in closed settings. Health Protection Agency. 2008.

³ Ludwig, E., et al. The remaining challenges of pneumococcal disease in adults. *European Respiratory Review* 21.123 (2012): 57-65.

⁴ Pneumococcal Disease – Chapter 25, 'The Green Book', Public Health England

In Northern Ireland (NI), *S. pneumoniae* isolates from usually sterile sites (e.g. blood, cerebrospinal fluid) are reported to the Public Health Agency (PHA) through routine voluntary laboratory reporting arrangements. Based on laboratory reporting, the average annual background incidence of invasive pneumococcal disease in NI was 6 cases per 100,000 population during 2010–2014, with higher rates in the very young and in those aged over 65 years⁵.

An outbreak of serious pneumococcal infection is defined as two or more cases of pneumococcal pneumonia or IPD being reported from a closed setting within a two-week period. Outbreaks of serious pneumococcal disease are relatively rare, and the majority that have been reported occurred in hospitals or long-term care facilities⁶. Outbreaks in children's day-care centres, schools and military barracks have also been reported.

⁵ Patterson, L., et al. Outbreak of invasive pneumococcal disease at a Belfast shipyard in men exposed to welding fumes, Northern Ireland, April–May 2015: preliminary report. *Euro surveillance: bulletin* 20.21 (2015).

⁶ Interim UK guidelines for the public health management of clusters of serious pneumococcal disease in closed settings. Health Protection Agency. 2008.

3. Chronology of the Outbreak

Wednesday 29th April 2015

The PHA Health Protection Duty Room is notified by Belfast Health and Social Care Trust (BHSCT) microbiology laboratory of two cases of IPD, with *S. pneumoniae* isolated on blood culture. Both cases presented to Mater Infirmorum Hospital (MIH), Belfast on 28th April and are foreign nationals temporarily working on the same oil rig in a shipyard in Belfast. One case is working as a welder, the other as a supervisor.

Additional information is obtained from cases and the shipyard regarding occupational roles and working patterns. No evidence of close contact between the two cases is elicited. It is identified that there are up to 700 employees working on the oil rig at any time. Shipyard management confirm that employees exposed to metal fumes are provided with individualised personal protective equipment (PPE). PHA emphasise the importance of compliance with PPE and sign-post senior management staff at the shipyard to the relevant Health and Safety Executive (HSE) guidance⁷. Case isolates are sent to the reference laboratory for typing.

Wednesday 13th May 2015

Notification is received to the duty room of two further cases of IPD (a welder and a heat treatment technician) who have been working on the same oil rig as the previous cases. One of the cases has been admitted to ICU. Both became unwell on 6th May. One case had *S. pneumoniae* isolated from blood cultures; the other had a positive pneumococcal urinary antigen test.

PHA makes further contact with senior management staff at the shipyard to establish links between these cases in the working environment and a site visit is conducted to inform the risk assessment and understand employee working patterns. An Outbreak

⁷ Pneumonia vaccination for employees exposed to welding and metal fume. Health and Safety Executive. January 2014.

Control Team (OCT) is convened and first meeting arranged for next morning, with request for specialist input from Public Health England (PHE).

Thursday 14th May 2015

The OCT, chaired by PHA, has its first meeting. The working patterns and roles of the confirmed cases are reviewed, including extent of exposure to metal fumes. It is identified that all of the confirmed cases are welders, or worked closely with welders, on the oil rig, however no subgroup of close contacts can be identified. Following consideration of the available evidence and multi-agency discussion, a decision is made that a core group at highest risk (i.e. those working on the rig who are exposed to metal fumes) is to be identified and offered antibiotic chemoprophylaxis and pneumococcal vaccination. Other employees will be provided with information and advice. A tailored information leaflet on pneumococcal disease for employees is developed, and a holding press statement is agreed.

Friday 15th May 2015

Senior shipyard staff are asked to identify employees who fall into the high risk occupational category and to provide them with information and invite them to attend prophylaxis and vaccination clinics. A further site visit is conducted by PHA to inform logistics of clinics.

PHA liaises with Health and Social Care Board (HSCB) and Belfast Health and Social Care Trust (BHSCT) to arrange procurement of antibiotics and vaccine via pharmacy department, as well as medical and nursing staff to prescribe and administer these and pharmacists to give pharmaceutical advice to medical staff. Interpreters are arranged via the shipyard and Business Services Organisation (BSO) as approximately one third of employees are foreign nationals, from a range of European countries including Poland, Russia, Lithuania and Norway. Staffing rotas for clinics are agreed and relevant documentation collated, including consent forms and prescribing guidance.

A European Early Warning and Response System (EWRS) alert is issued to inform other countries of the outbreak and encourage reporting of potential cases that may have already left Northern Ireland.

Saturday 16th May – Monday 18th May 2015

Daily vaccination and antibiotics clinics, staffed by PHA and BHSCCT employees, are held on site at the shipyard with approximately 200-300 shipyard employees attending per day. A revised risk assessment on 17th May identified additional occupational categories deemed to be at increased risk. Overall, 680 individuals are provided with information and offered antibiotic prophylaxis and vaccination.

Some attendees who appear unwell are clinically examined at the clinics and four are referred to the emergency department for further assessment. Notification is also received of workers who reported having recently been diagnosed with chest infections, both from HR and self-reporting at the vaccine clinic. All of these individuals are followed up to assess whether they meet the case definition. Five people are subsequently agreed as probable cases during the course of the investigation.

A PHA incident management meeting is held on 18th May 2015. It is acknowledged that the PHA Duty Room is receiving significant volumes of calls from members of the public and shipyard employees who are concerned about their risk. Guidance is developed to aid risk assessment and standardise advice.

Further correspondence is issued to HSC Trusts, out-of-hours GP services and GPs in Northern Ireland to provide an update on the situation (Appendix 3).

Tuesday 19th May 2015

HSENI carry out a compliance assessment visit to shipyard. No major issues are identified. PHA follows up any potential cases identified at clinics or notified from Trusts/GPs to ascertain if there is evidence of pneumococcal disease.

Thursday 21st May 2015

A further OCT meeting takes place. It is agreed that PHA will continue to review the risk assessment and provide advice to management staff at the shipyard. Shipyard management are arranging further vaccination clinics delivered by private companies for employees who missed PHA clinics. HSENI agree to take forward promotion of HSE guidance on pneumococcal vaccination⁸ with large companies employing welders in Northern Ireland.

Wednesday 27th May 2015

A 'hot debrief' event is held to encourage reflection and capture learning from the outbreak, with representatives from PHA, HSCB, BHSCT, PHE and Port Health.

Tuesday 9th June 2015

A further PHA incident management team meeting is held. No further confirmed cases have been identified.

Wednesday 10th June 2015

The PHA duty room is notified of a patient who works as a cleaner/labourer on the oil rig who was admitted on 9/6/15 via the Emergency Department with evidence of pulmonary consolidation on chest radiograph. It is agreed that this case meets the definition of a probable case. This case was on leave from the shipyard during the vaccination and antibiotic clinics, but would have met the definition for inclusion at the clinics because of his occupation.

⁸ Pneumonia vaccination for employees exposed to welding and metal fume. Health and Safety Executive. January 2014.

Friday 12th June 2015

Microbiological testing (blood culture and urinary antigen) is negative for *S. pneumoniae*. Following discussion between PHA, microbiology and the respiratory physician it is agreed that pneumococcal disease remains the most likely diagnosis.

Tuesday 7th July 2015

From the end of May work on the oil rig was nearing completion and the shipyard informed PHA that workers leaving the site were now not being replaced. The oil rig leaves the shipyard on 7th July. The outbreak is declared over.

4. Methods

4.1 Epidemiological

4.1.1 Case definitions

Specific case definitions were agreed for the purpose of the outbreak investigation and case finding. Confirmed, probable and possible cases were defined as follows:

Confirmed case: *An individual who has worked at the Belfast shipyard since 19 January 2015 and presents with a clinical diagnosis of IPD or pneumococcal pneumonia AND at least one of the following: pneumococcus isolated from normally sterile site (blood, cerebrospinal fluid (CSF), joint, peritoneum, pleural fluid or other, but not sites such as eye), pneumococcal DNA or antigen detected in fluid from a normally sterile site or pneumococcal antigen detected in urine.*

Probable case: *An individual who has worked at the Belfast shipyard since 19 January 2015 and presents with a clinical diagnosis of IPD or pneumonia (supported by radiographic imaging) where serious pneumococcal disease based on available clinical, microbiological and epidemiological evidence is the most likely diagnosis, in the absence of laboratory confirmation.*

Possible case: *An individual who has worked at the Belfast shipyard since 19 January 2015 and presents with a clinical diagnosis of IPD or pneumococcal pneumonia (supported by radiographic imaging) where diagnoses other than serious pneumococcal disease are at least as likely.*

4.1.2 Data collection

Information was collected on confirmed and probable cases including patient identifiers and demographic characteristics, risk factors for IPD, clinical details, microbiological investigations, vaccination status and onsite working patterns of the occupational groups at increased risk. Information was obtained on all individuals who attended the prophylaxis and vaccination clinics, including relevant medical history (to inform appropriate prophylaxis choice) and current smoking status, enabling further characterisation of this group.

4.1.3 Case finding

Retrospective case finding was conducted through examination of laboratory-confirmed reports of IPD in males aged 18-64 years with specimen dates in 2015. Telephone contact was made with the cases' general practitioners (GPs), or the cases directly to ascertain their occupation and ascertain if there was any link to the shipyard.

Prospective case finding was undertaken through local, national and international alerting. Communications were sent to all Health and Social Care Trusts and General Practitioners in Northern Ireland, alerting them to the outbreak and encouraging reporting of potentially linked cases (Appendix 2). Further cases of laboratory confirmed IPD up until the end of July 2015 would be examined for links with the shipyard. As many of the employees were ordinarily resident in other parts of the UK and Europe, an Early Warning Response System (EWRS) European alert was also issued, advising of the outbreak and encouraging reporting of potentially linked cases.

4.2 Microbiological

Microbiological samples from suspected cases were collected and processed according to routine clinical and microbiological protocols, via BHSCT Laboratories. Isolates from confirmed cases were forwarded to the PHE Respiratory and Vaccine Preventable Bacteria Reference Unit (RVPBRU) for further characterisation.

In order to provide information about current circulating serotypes in the community, other isolates of *S. pneumoniae* from sterile sites obtained between March and May 2015 in Belfast HSC Trust from patients not known to be associated with the outbreak (including males and females of all ages) were identified and forwarded to RVPBRU for typing.

4.3 Environmental Health

A site visit was conducted on the evening of 13th May by PHA and port health to inform the risk assessment. During this visit there was a discussion with the shipyard health and safety officers regarding the general working patterns on the site, as well as the cases working patterns specifically.

A tour of the dockside facilities for the workers was also undertaken to investigate whether any groups of close contacts of the cases could be identified either at the dockside facilities where the workers ate or changed clothes, or on the rig itself.

An HSENI team, including a microbiologist and a staff member with particular experience of welding / ship building environments conducted a site visit on 19th May. Air handling equipment and the number of air changes were discussed. Confined space entry protocols and PPE were reviewed. Welfare facilities on the site were discussed and a sample checked. A follow up meeting was conducted on the 17th of June to review management of risks associated with dust and fumes and the use of RPE (Respiratory Protective Equipment).

5. Results

5.1 Epidemiological

5.1.1 Descriptive epidemiology

Four confirmed cases of IPD were identified, with dates of onset of illness between 28th April 2015 and 6th May 2015. All were male, with a median age of 39, and were either UK or other European country nationals. All had evidence of acute pneumonic changes based on radiographic findings. All required significant periods of hospitalisation, ranging from 6 to 19 days. One case had treatment in an intensive care unit as part of their inpatient stay. Two of the confirmed cases had underlying risk factors, and all of the confirmed cases were current smokers. Three of the confirmed cases were welders; the other reported working closely alongside welders in enclosed spaces on the rig.

An additional five individuals met the probable case definition. All presented to hospital between 23rd April and 9th June 2015. All were male and in occupations exposed to metal fumes, working in enclosed spaces on the rig. All had radiographic changes of pulmonary consolidation. Two required treatment with IV antibiotics, with the other three receiving oral antibiotic therapy only. None had microbiological confirmation of pneumococcal disease. The characteristics of the confirmed and probable cases are summarised in Table 1. Both of the cases who presented after the vaccine and prophylaxis clinics were off work during the clinic period.

A further 16 symptomatic shipyard workers were notified to PHA in association with the outbreak, reported either through attendance at vaccine and prophylaxis clinics, or notification from clinicians in primary or secondary care. All were followed up with regard to clinical diagnosis and laboratory results. None of these met the case definitions.

680 individuals attended prophylaxis and vaccination clinics. The median age of attendees was 41 years (range 19 – 72 years). 656 (96%) received antibiotic prophylaxis, with azithromycin being the agent of choice for 92% (605/656) . 630 (93%) received PPV vaccination. Although not collected systematically, it was noted

that a significant proportion complained of current or recent respiratory symptoms; 109 (16.0%) reported respiratory symptoms within the last 2 months. 289 (42.5%) of those attending reported that they currently smoked and 43 (6.3%) had medical comorbidities associated with increased risk of IPD. Five individuals (0.8%) recalled having previously received vaccination against pneumococcal disease.

5.1.2 Case finding

Sixteen further cases of IPD in males of age 18-64 were identified through routine laboratory surveillance reports to PHA from 1st January to end July 2015 across Northern Ireland microbiology laboratories. None were identified as having any link with the shipyard; however, two were identified as welders working elsewhere. Advice was given regarding the association between welding and IPD, and consideration of vaccination recommended to reduce the risk of IPD in the future.

Table 1. Summary of confirmed and probable cases identified in shipyard outbreak of invasive pneumococcal disease

	Source of notification	Presentation	Admitted to hospital	Welder	Smoker	Radiographic findings	Microbiological findings
Confirmed cases	Microbiology laboratory	Acute pneumonia	Yes	No*	Yes	Left lower lobe pneumonia with associated effusion	<i>S. pneumoniae</i> serotype 4 isolated from blood culture
	Microbiology laboratory	Acute pneumonia	Yes	Yes	Yes	Left lower lobe consolidation with associated effusion	<i>S. pneumoniae</i> serotype 4 isolated from blood culture
	Microbiology laboratory	Acute pneumonia	Yes	No*	Yes	Left lower lobe consolidation	<i>S. pneumoniae</i> serotype 4 isolated from blood culture
	Microbiology laboratory	Acute pneumonia	Yes	Yes	Yes	Multi-lobar right sided consolidation	Positive pneumococcal urinary antigen test - not able to be typed
Probable cases	Retrospective notification from HR department at shipyard	Acute pneumonia	Yes	No*	Unknown	Right sided consolidation	Blood cultures - negative
	Reported at vaccination clinic	Acute pneumonia	Yes	Yes	Unknown	Consolidation left lower lobe, left lingual lobe and pleural effusion	Sputum – no significant growth Blood cultures - negative
	Reported at vaccination clinic	Acute pneumonia	No	No*	Unknown	Consolidation at base of right upper zone	Sputum – no significant growth
	Emergency department	Acute pneumonia	No	No*	Unknown	Air space opacification in the right lower lobe	No sputum or blood cultures sent
	Microbiology laboratory	Acute pneumonia	Yes	No*	Yes	Left lower zone consolidation	Blood culture – coag. Negative <i>staphylococcus</i> –likely contaminant Urinary antigen negative

*Occupations of those who were not welders included roughneck, heat treatment technician, rigger, foreman, metal fitter and cleaner. All of the probable or confirmed cases who were not welders gave a history of working closely alongside welders, in enclosed spaces on the oil rig.

5.2 Microbiology

S. pneumoniae was isolated from blood cultures from three cases. All isolates were identified as *S. pneumoniae* serotype 4, a strain which has previously been associated with outbreaks⁹. Isolates were fully sensitive to penicillin and erythromycin. A fourth case was confirmed through a positive urinary antigen test. The urinary antigen positive sample was not able to be typed by the reference laboratory.

Ten *S. pneumoniae* sterile site isolates with specimen dates between March and May 2015 from cases not associated with the outbreak were also typed. These cases comprised 4 males and 6 females, with a median age of 67.5 years. The serotypes identified are summarised in table 2. None of the isolates were identified as serotype 4, suggesting that serotype 4 was not circulating widely in the community at the time of the outbreak.

Table 2. Typing of *S. pneumoniae* isolated between March and May 2015 from sterile sites of cases not associated with outbreak

Sample Date	Isolation Site	<i>S. pneumoniae</i> Serotype Identified
03/2015	Blood culture	Serotype 11A
03/2015	Blood culture	Serotype 35B
03/2015	Blood culture	Serotype 22F
03/2015	Blood culture	Serotype 12F
03/2015	Blood culture	Serotype 11A
04/2015	Blood culture	Serotype 8
04/2015	Blood culture	Serotype 35B
05/2015	Blood culture	Serotype 8
05/2015	Joint Fluid	Serotype 12F
05/2015	Blood culture	Serotype 24F

⁹ Hausdorff, William P., Daniel R. Feikin, and Keith P. Klugman. Epidemiological differences among pneumococcal serotypes. *The Lancet infectious diseases* 5.2 (2005): 83-93.

5.3 Environmental Health

5.3.1 Date of Commencement

The oil rig arrived in the Belfast shipyard on 19th January 2015, for major refurbishment works.

5.3.2 Description of the Site

The shipyard site has a dockside area containing office blocks and large warehouses, as well as permanent and temporary amenities blocks where groups of workers change their clothes and eat. The oil rig itself was located in a dry dock adjacent to the dockside area and workers access the oil rig by means of a lift on the outside of the rig.

Access to the site is strictly controlled by security at the entrance.

5.3.3 Description of the Workforce

The make up of the workforce was extremely complex due to the scale of the project and the highly skilled workforce required.

During the site visit on 13th May the shipyard estimated that approximately 3000 people had been employed on the project so far, with around 1500 people on the shipyard site at any one time. Workers on the site were mainly either working exclusively dockside in the warehouses, offices and amenity blocks, or exclusively on the oil rig itself. It was estimated that approximately 700 people worked on the oil rig during the day and 400 at night time. Those working on the rig were welders, standby firemen, labourers, electricians, cleaners and supervisors. Work was being carried out all over the rig, so workers could be on the top of the rig working outside, or inside the rig, in the enclosed spaces of the pontoons at the bottom, the legs of the rig and the cross-brace. Workers on the oil rig returned to the dockside amenities blocks for break times and workers each had a specifically allocated amenities block.

Some workers were employed directly by the shipyard company or the oil rig owner, but many were employed by six large contractors, and some by one of the many minor contractors. Approximately a third of the workers were resident in Northern

Ireland, a third from other parts of the UK and a third from outside the UK, including EU and non-EU countries.

Workers had a variety of shift patterns, usually working 12 hours a day with 5 or 6 days “on” and 1-2 days “off”, or 2 to 3 weeks “on” and 1-2 weeks “off” depending on their contractor.

5.3.4 Provision of Occupational Health and other healthcare services

Occupational Health services were provided to the workers by their contractor. As many of the contractors were not based in Northern Ireland, most of the occupational health services were not provided locally or were not easily accessible at the time of the outbreak. As only a third of the workers lived in Northern Ireland, most were not registered with a General Practitioner in Belfast. Usual practice was that if workers became ill at work, they were sent to a hospital emergency department for assessment.

5.3.5 Assessment by HSENI

Inspection of work activities on the rig indicated that, at the time of inspection, they were adequately managed

Air handling equipment was observed in use where confined space work was being undertaken in areas such as the cross bracing and the rig legs. The number of air changes in these confined spaces was also discussed. Confined space entry protocols were in place and operating effectively, however HSENI staff did not enter confined spaces for operational reasons. The types of Respiratory Protective Equipment (RPE) used on the rig, including face fit testing was reviewed.

A number of minor issues were raised with the site safety team and subsequently were reviewed with site management.

6. Control Measures

6.1 Co-ordination and management of the outbreak

All OCT meetings were chaired by PHA. Membership and organisations represented on the OCT are provided in Appendix 1.

Key roles were provided as follows:

- Epidemiological investigation of cases coordinated by PHA
- Microbiological investigation coordinated by BHSCT Laboratories, with further characterisation carried out by PHE Respiratory and Vaccine Preventable Reference Unit (RVPBRU).
- Environmental investigation coordinated by HSENI
- Media communications and spokesperson provided by PHA
- Administrative support provided by PHA

6.2 Prevention of further cases

The Interim UK guidelines for the Public Health Management of Clusters of Serious Pneumococcal Disease in Closed Settings (2008) identify primary intervention strategies as:

- Providing information
- Offering antimicrobial prophylaxis and vaccination (with conjugate or polysaccharide vaccines) to defined close contacts.

The OCT agreed that those at greatest risk in the context of this outbreak were those exposed to metal fumes and working on the rig during the outbreak. It was identified that the job roles which met these criteria included welders, pipe fitters, steel workers, supervisors of welders and any others who are exposed to metal fumes and working in confined spaces on the rig.

The OCT agreed that to provide both immediate and longer term protection, the most appropriate strategy would be to offer those in the high risk group antibiotic chemoprophylaxis and vaccination. Information and advice would also be provided to all employees.

A dedicated information leaflet was developed and made available to the entire workforce, prior to and during antibiotic/vaccination clinics (Appendix 5).

6.3 Antimicrobial Prophylaxis

Those in the high risk occupational groups were offered antimicrobial prophylaxis with the aim of reducing carriage of the outbreak serotype of pneumococcus amongst close contacts and thereby interrupting transmission in the group¹⁰. It is also thought to offer a degree of individual protection against serious disease amongst any who may be in the incubation phase of pneumococcal infection.

Azithromycin (500mg OD orally for 3 days) was selected as the primary choice as it was felt the relative short, once-daily dosing regime would aid compliance. For those with contraindications to azithromycin, amoxicillin (500mg BD orally for 7 days) was used as an alternative. Prophylaxis was prescribed and dispensed at dedicated clinics, with doctors assessing suitability for antibiotic therapy, and explaining the rationale, dosing schedule and potential side effects, via interpreting staff where necessary. Pharmacists were required to provide advice on drug information, interactions or contraindications due to other medications individuals were taking

6.4 Vaccination

Vaccination was offered at the same time as antimicrobial prophylaxis to those at risk with the aim of providing longer term protection. This is thought to take approximately 10-14 days to develop, hence the need for antimicrobial prophylaxis to provide more immediate protection. Two types of pneumococcal vaccine are presently licensed in the UK, which include a variable number of capsular serotypes: the 23-valent-pneumococcal polysaccharide vaccine (PPV) and the 13-valent pneumococcal conjugate vaccine (PCV). National guidance recommends that the PCV13 is used when the outbreak serotype is represented in the vaccine. However, the OCT agreed that PPV23 vaccine should be used in order to protect not only

Interim UK guidelines for the public health management of clusters of serious pneumococcal disease in closed settings. Health Protection Agency, 2008.

against the outbreak serotype, but also the greatest number of additional serotypes given that this occupational group would be at ongoing risk from pneumococcal disease. As vaccine effectiveness of PPV23 is estimated at 50–70%, it was emphasised to employees receiving the vaccine that they should continue to be aware of the signs and symptoms of pneumococcal disease, and comply with use of PPE and other occupational control measures.

6.5 Public Information

A media statement was issued by PHA communications team on 15th May 2015 (Appendix 4).

7. Discussion

This is the first outbreak of IPD in the context of an oil rig or ship yard setting that we are aware of. Outbreaks of pneumococcal disease have been described in other settings including nursing homes, hospitals, schools, military camps and prisons¹¹, and there are reports of outbreaks of other pathogens, including Influenza B, on an oil rig¹². Factors thought to have contributed to this outbreak include large numbers of individuals with increased susceptibility to IPD (due to metal fume exposure) working in close proximity, for prolonged periods in small, confined spaces on the oil rig, combined with the circulation of *S. pneumoniae* serotype 4, a serotype known to be associated with outbreaks.

The setting of this outbreak led to a number of complexities with regard to implementation of control measures. One of the particular difficulties was the identification of close contacts at high risk, as recommended as part of PHE guidance. There was no evidence of the four confirmed cases being part of a particular subgroup of oil rig workers. All employees worked across all sections of the oil rig and did not operate in fixed groups. The cases also did not share a single amenity block or employer. Following discussion, it was agreed that all of those working on the rig with exposure to metal fumes (include welders, pipe fitters, steel workers and supervisors working closely with welders) should be offered antibiotic chemoprophylaxis and vaccination. This amounted to an estimated 300 individuals, with the final total being significantly greater (680) due to widening of the occupational groups felt to be at increased risk.

The oil rig did not constitute a 'closed setting' in the way that a hospital or nursing home might, as the employees were only there during their working hours; other time was spent in the wider community, with overnight stays taking place in hotels across Belfast or private households. Rig workers also shared common facilities with other dockside workers. This mixing decreased the likelihood that clearance of the organism would be fully achieved from the administration of chemoprophylaxis.

¹¹ Ihekweazu, Chikwe, et al. Outbreaks of serious pneumococcal disease in closed settings in the post-antibiotic era: a systematic review. *Journal of Infection* 61.1 (2010): 21-27.

¹² Johnston, F., et al. An outbreak of influenza B among workers on an oil rig. *Communicable diseases intelligence* 21.8 (1997): 106-106.

Additional difficulty in the implementation of control measures and management of symptomatic workers arose from the multi-national nature of the group at risk. Of those working on the rig, approximately one third were ordinarily resident outside of the UK and a further third were resident in other parts of the UK outside Northern Ireland. As a result, the majority of rig workers were not registered with a primary care provider in Northern Ireland. This, combined with the large size of the group needing prophylaxis and vaccination, meant that it was not appropriate to advise those in risk groups to attend primary care to arrange prophylaxis or vaccination.

Dedicated clinics were developed to ensure chemoprophylaxis and vaccination could be offered to all in the target group. To complement the clinical workforce, interpreters were required to ensure adequate communication in a variety of languages, including Lithuanian, Polish and Russian. While the majority of interpreters were obtained via BSO (Business Services Organisation), on occasion employees nominated a colleague to interpret for them, particularly for the less well represented languages e.g. Bulgarian. Availability of an appropriate interpreter was often noted to be the rate-limiting step at the clinics. Over the course of the clinics, greater efficiency was achieved by ensuring those invited to the clinic matched interpreter availability for that particular time.

Many workers were on regular medications which required identification as they had been prescribed outside the UK and brought over by the worker. Azithromycin is contraindicated with a number of routine medications so on site pharmacist advice provided assistance to prescribers where there was uncertainty.

An additional issue encountered was the lack of overarching occupational health oversight structures for the site. Workers on the oil rig were provided by numerous different employers, including the shipyard, oil rig owner, six major and many minor contractors from across Europe. Each employer had its own occupational health department; the majority of which were not located in Belfast. As a result, there was a lack of easily accessible occupational health support for the cohort of individuals working on the oil rig in Belfast.

National guidance recommends that consideration be given to the need for vaccination of welders with PPV 23 pneumococcal vaccine, taking into account occupational exposure control measures in place. Based on information collected

from those attending the vaccination and prophylaxis clinics, only a small proportion (0.8%) recalled having received vaccination previously. While it is emphasised that vaccination is not a substitute for PPE and other risk reduction measures, this outbreak suggests that exposure control measures alone may not always be sufficient to reduce the risk of pneumococcal disease. Furthermore, welders may move between numerous workplaces, often across different countries, and the control measures in place may vary between locations. It should also be noted that all of the confirmed cases and 42.5% of the employees attending the outbreak clinics were current smokers. Smoking is also known to increase the risk of pneumococcal disease and so this may have increased the susceptibility to disease of those who became unwell. Employers of welders should be encouraged to offer smoking cessation services to their employees which may further reduce the risk of IPD in this susceptible group.

Two probable cases of IPD were reported in shipyard workers after the implementation of control measures. Although in at risk occupational groups these individuals had not received chemoprophylaxis or vaccination as they were off work at the time of the clinics. Although we are unable to account for the impact of the (planned) downscaling of the project workforce soon after the outbreak was recognised, these additional cases would appear to support the risk assessment and range of control measures as reported.

8. Recommendations

8.1 For the shipyard:

- The shipyard should review its occupational health structures, particularly for those who are temporarily contracted and do not have a local GP.
- The adequacy of PPE should be reviewed, including assessment of compliance, and consideration given to vaccination against pneumococcal disease for staff exposed to metal fumes.
- The shipyard should consider offering smoking cessation services to employees to improve their general health and further reduce the risk of IPD.

8.2 For HSENI:

- Ensure companies employing welders are aware of guidance, and have adequate systems of occupational health management.

8.3 For employers of large transient multinational workforces:

- Other employers of large transient multinational workforces should also note the lessons from this outbreak about the importance of provision of local occupational health services and information on temporary registration with a general practitioner where they are working.

Appendix 1 – Membership of Outbreak Control Team

Dr L Doherty (Chair) Dr L Jessop (Incident Lead) Dr L Patterson Dr A Wilson Dr N Irvine Ms V Johnston	Public Health Agency
Mr M Dolan Ms B Bradley	Health and Social Care Board
Dr A Loughrey Dr E Dorgan Ms C Parkes	Belfast Health and Social Care Trust
Mr T Hutchinson Mr P Beattie Mr H McIlvenny	Shipyards
Mr B Monson Mr C Anderson	Health and Safety Executive, Northern Ireland
Mr D McClenaghan Mr T McKillen	Belfast City Council
Dr M Ramsay Dr S Mandal	Public Health England
Prof A Scott	London School of Hygiene and Tropical Medicine

The following individuals also represented the core OCT organisations at some OCT Meetings: Public Health Agency Staff - Dr A Baker, Dr J Ewing, Ms G Reid, Ms H Crookshanks, Ms S Kelly, Ms S Wilton, Dr R Smithson .. Belfast Health and Social Care Trust Staff - Ms M Carey, Ms J Tolan, Ms C Conroy, Ms Rhona Fair and Mr D Knott (Belfast Harbour)

Acknowledgements

The OCT would like to gratefully acknowledge the assistance of all the clinical, administrative and interpreting staff who assisted in the running of the clinics, to Dr Joe Kidney for reviewing the probable cases and RVPBSU for undertaking the typing work.

Appendix 2 – Communication to Health and Social Care Trusts and General Practitioners in Northern Ireland



12-22 Linenhall Street
Belfast
BT2 8HS

By email

T: 028 95363474
F: 028 95363947
Web Site: www.publichealth.hscni.net

15th May 2015

Trust Medical Directors
All GPs
GP OOHs

Dear Colleagues

Cluster of cases of invasive pneumococcal disease associated with [REDACTED] Shipyard site

I am writing to alert you that PHA and partners are investigating a cluster of four cases of invasive pneumococcal disease in people who are workers at the [REDACTED], Belfast shipyard site.

Cases had disease onset dates between 28th April 2015 and 6th May 2015. Clinical presentations included bacteraemia and lobar pneumonia.

I would ask colleagues to be vigilant for cases of possible invasive pneumococcal disease in shipyard workers, and consider early treatment and investigation.

I would be grateful if any cases of possible invasive pneumococcal disease associated with the shipyard could be reported to the PHA Duty Room on 0300 555 0119.

Kind regards

A handwritten signature in black ink that reads 'Lorraine Doherty'.

Dr Lorraine Doherty
Assistant Director of Public Health (Health Protection)

Cc Dr C Harper, DPH
PHA Duty Room

Appendix 3 – Further Communication to Health and Social Care Trusts and General Practitioners in Northern Ireland



12-22 Linenhall Street
Belfast
BT2 8HS

By email

T: 0300 555 0119
F: 028 95363947
Web Site: www.publichealth.hscni.net

18th May 2015

Trust Medical Directors
Trust Nursing Directors
All GPs
GP OOHs

Dear Colleagues

Outbreak of invasive pneumococcal disease associated with [REDACTED] (Belfast) Shipyard site

Further to my letter of May 15th, I am writing to update you on the outbreak of pneumococcal disease associated with the [REDACTED], Belfast shipyard site. The Health Protection Service, Public Health Agency, identified four cases of invasive pneumococcal disease in people who are workers at the ship yard and initiated an investigation.

Cases had disease onset dates between 28th April 2015 and 6th May 2015. Clinical presentations included bacteraemia and lobar pneumonia. No further cases have been identified since my last letter on this issue.

Public Health Management

A detailed risk assessment was undertaken between PHA medical staff, [REDACTED], HSENI and supported by experts in pneumococcal disease from Public Health England. It is known that welders and people exposed to welding dust are more susceptible to pneumococcal disease. The risk assessment enabled identification of the workers considered to be most vulnerable to

pneumococcal disease, by way of their occupation and working environment at the shipyard. These workers have been offered antibiotic prophylaxis and pneumococcal polysaccharide vaccine.

Over the weekend of May 16-17 PHA and Belfast Trust worked together to give antibiotic prophylaxis and pneumococcal vaccine to 450 workers at [REDACTED] shipyard. Further workers are being assessed and offered the intervention today. First line antibiotic used was azithromycin 500 mg OD for 3 days and second line was amoxicillin 500 mg BD for 7 days.

I would ask colleagues to continue to be vigilant for cases of possible invasive pneumococcal disease in shipyard workers, who also describe exposure to metal fumes and/or dusts associated with welding, and consider early treatment and investigation.

I would be grateful if any cases of possible invasive pneumococcal disease associated with the shipyard could be reported to the PHA Duty Room on 0300 555 0119.

Further information on pneumococcal disease available at -

<https://www.gov.uk/government/collections/pneumococcal-disease-guidance-data-and-analysis>

Kind regards



Dr Lorraine Doherty

Assistant Director of Public Health (Health Protection)

cc. Dr Carolyn Harper
Dr Michael Mc Bride, CMO
Dr Anne Kilgallen, DCMO
Dr Elizabeth Reaney, SMO
Mr Seamus Camplisson, DHSSPS
PHA Duty Room

Appendix 4 – Press Release Issued 15th May 2015 regarding IPD Outbreak

Pneumococcal disease cluster - [REDACTED]

The Public Health Agency (PHA) is working with the Health & Safety Executive Northern Ireland (HSENI) and Port Health colleagues to investigate a cluster outbreak of pneumococcal disease at [REDACTED], Belfast.

A small number of employees working at [REDACTED] have been confirmed as having pneumococcal disease.

The PHA is working closely with [REDACTED] and hygiene advice has been given to employees. Vaccination is being offered to employees working in high risk exposure areas as a preventative measure.

There is no wider risk to the public from pneumococcal disease as regards this cluster.

Questions & Answers on Pneumococcal Disease

Q. What is Pneumococcal disease?

Pneumococcal disease is a term used to describe the range of infections which can be caused by a bacterium called *Streptococcus pneumonia*

Q. What kind of illness do the bacteria cause?

The bacteria can cause a variety of infections ranging from sinusitis and ear infections to more serious illnesses such as pneumonia, meningitis and blood-poisoning.

Q. How do you catch it?

The bacteria which cause pneumococcal infections can be spread by close contact with someone who is carrying the bacteria when that person coughs or sneezes. They can also be spread by direct contact with respiratory secretions from an infected person, such as used paper tissues.

Some people can carry the bacteria in the backs of their noses and throats without ever becoming ill while others can go on to develop a pneumococcal infection. It is not known why it only affects some people but it is known that some groups of people are more at risk than others of developing it. These groups include:

- the very young or the very old
- people with a chronic illness such as diseases of heart, lung, kidneys, liver or diabetes mellitus
- people without a spleen or with a damaged spleen
- people whose immune system is not working properly
- welders or people exposed to welding fumes in their job

Q. What measures can I take to prevent the spread of pneumococcal infection?

Taking simple hygiene precautions is encouraged. This includes:

- washing your hands thoroughly and regularly- this is particularly important after touching your nose and mouth and before handling food
- coughing and sneezing into a tissue, throwing it away immediately and washing your hands
- using your own cups and utensils and not sharing these with others

Q. Can you catch a pneumococcal infection from close contact with someone who has it?

The vast majority of people who come into contact with someone with a pneumococcal infection remain well and symptom free. However, it is possible to contract pneumococcal disease from close contact with an infected person.

Q. Can people be immunised against pneumococcal disease?

Yes, pneumococcal vaccination is very effective at preventing pneumococcal infection. However, the vaccines only protect against certain types of pneumococcal disease. Vaccination may reduce the risk of pneumococcal disease, but should not replace measures to prevent or reduce exposure.

Q. Why are some workers being offered vaccination and antibiotics and others not?

At present, only individuals who have been identified in this situation, as having an increased risk of developing a pneumococcal infection will be offered vaccination and antibiotics.

Q. What are the symptoms of pneumococcal disease?

Most people come into contact with the bacteria which can cause pneumococcal disease every so often and remain well. Developing a serious pneumococcal infection after coming into contact with an infected person is rare.

However, if you develop any of the following symptoms over the next few weeks you should seek medical attention, show this leaflet to the doctor or nurse assessing you and explain that there have been people in your workplace recently who have had pneumococcal disease. The symptoms to watch out for are:

- a severe cough
- shortness of breath
- chest pains
- confusion or drowsiness
- a severe prolonged headache
- stiff neck, aversion to light
- fever
- seizures